exhibiting a free swell index of between ab ut 3.5 and about 5.0 and of a small diameter, having a density f between about 0.1 and about 0.8 g/cm^3 and a thermal conductivity below about 1 W/m/°K.

12) The laminated sheet product of claim 11 wherein said coal exhibits a free swell index of between about 3.75 and about 4.5.

13) The laminated sheet product of claim 12 wherein said skins comprise a material selected from the group consisting of aluminum, steel, polymer sheet, inconel, titanium, refractory metals, fiber reinforced polymer sheet and paper.

14) The laminated sheet product of claim 12 wherein said sheet core has been carbonized.

15) The laminated sheet product of claim12 wherein said sheet core is graphitized.

16) A semi-crystalline, largely isotropic, coal-based carbon foam having a thermal conductivity below about 1 W/m/°K.

17) The carbon f am of claim 1 having a density of between about 0.1 and ab ut 0.8 g/cm^3.

18) A coal-based carbon foam produced by the direct heating of comminuted coal particles in a pressure controlled mold and under a non-oxidizing atmosphere to a temperature ranging from about 300° C to about 700° C.

19) A method for producing carbon foam comprising directly heating comminuted coal particles in a pressure controlled mold to a temperature ranging from about 300° C to about 700° C.

20) A method for producing a coal-based carbon foam comprising:

A) comminuting coal containing adequate volatiles to permit foaming thereof upon the application of heat, to a small particle size to form a ground coal;

C) placing said ground coal into a mold;

D) heating said ground coal in said mold under a non-oxidizing atmosphere to a temperature and for a period adequate to produce a controlled foaming of said coal to form a preform; and

E) controllably cooling said preform.

Abstract

According to the present invention there is provided a porous coal-based material having a density of between about 0.1g/ cm^3 and about 0.6 g/cm^3 that is produced by the controlled heating of small coal particulate in a "mold" and under a non-oxidizing atmosphere. The coal starting material preferably exhibits a free swell index of between about 3.5 and about 5.0 and most preferably between about 3.75 and about 4.5. The porous product thereby produced can be machined, adhered and otherwise fabricated to produce a wide variety of low cost, low density products, or used in its preformed shape as a filter, heat or electrical insulator etc. Such porous products, without further treatment exhibit compressive strengths of up to about 6000 psi. Further treatment by carbonization or graphitization yields products that can be used as electrical or heat conductors. Methods for the production of these coal-based cellular products are also described.